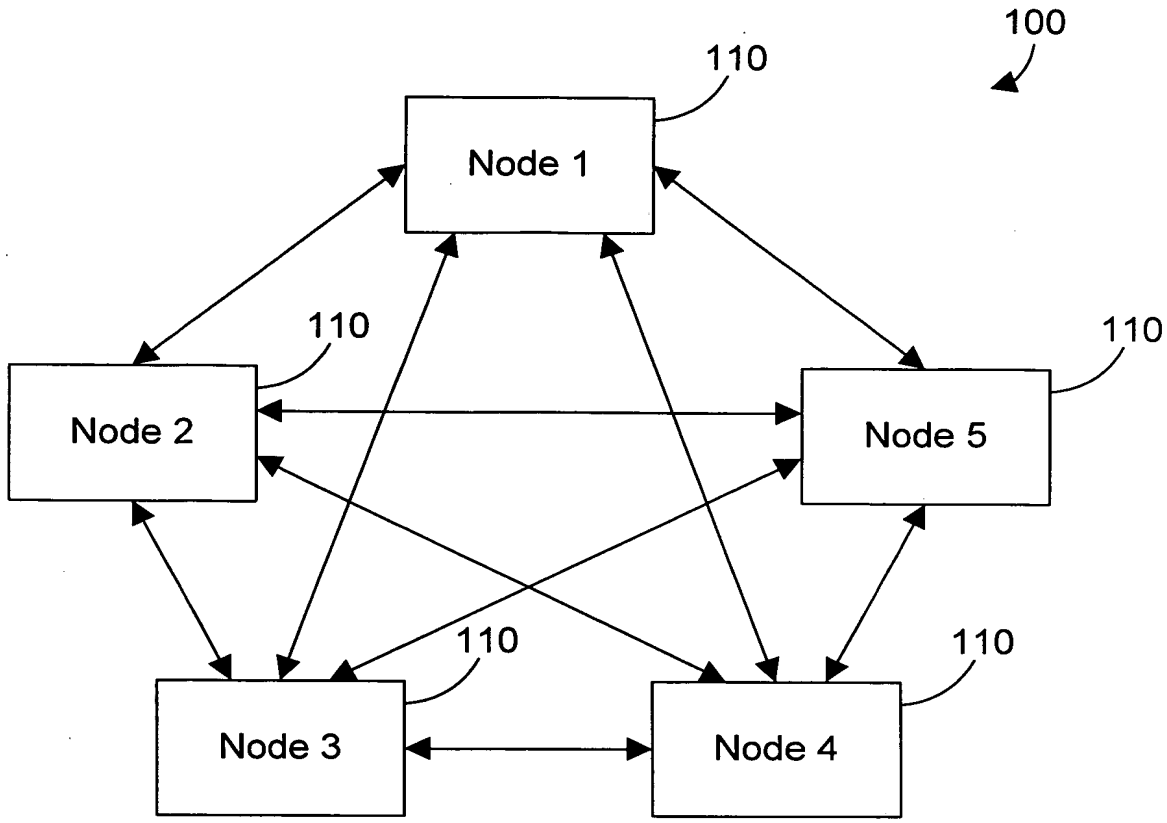


FIG. 1

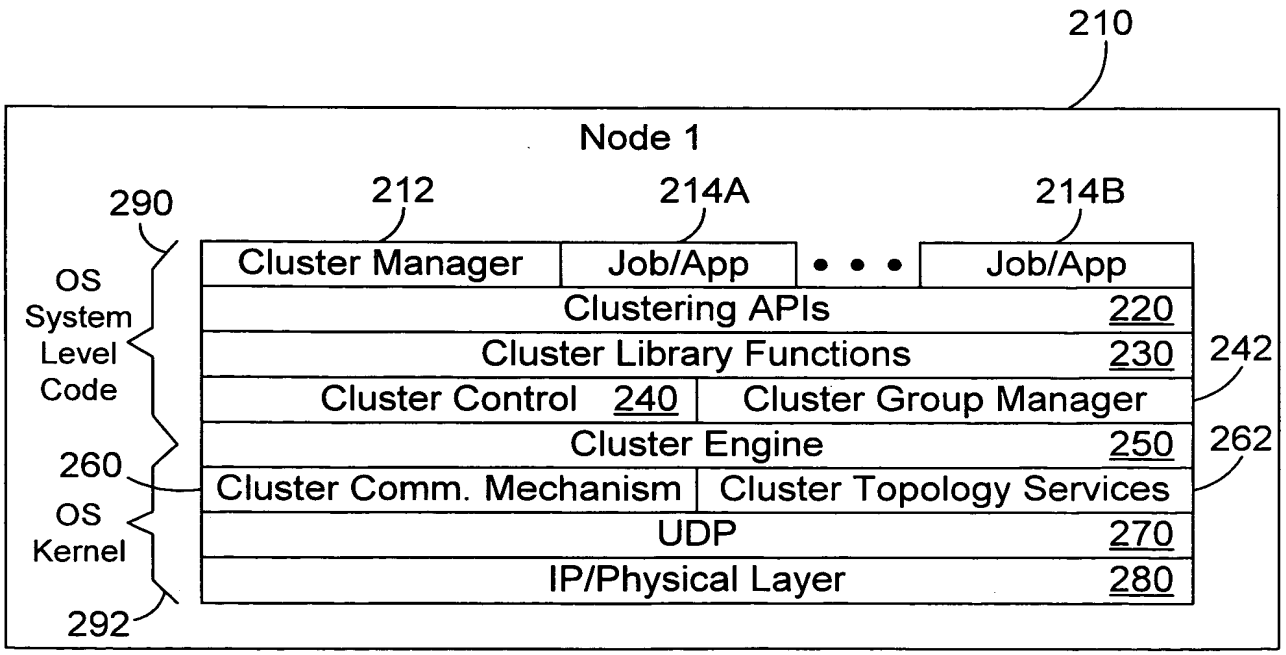


FIG. 2 Prior Art

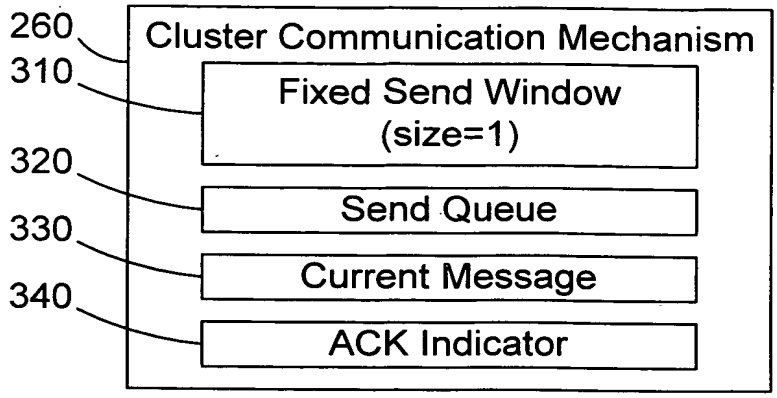


FIG. 3

Prior Art

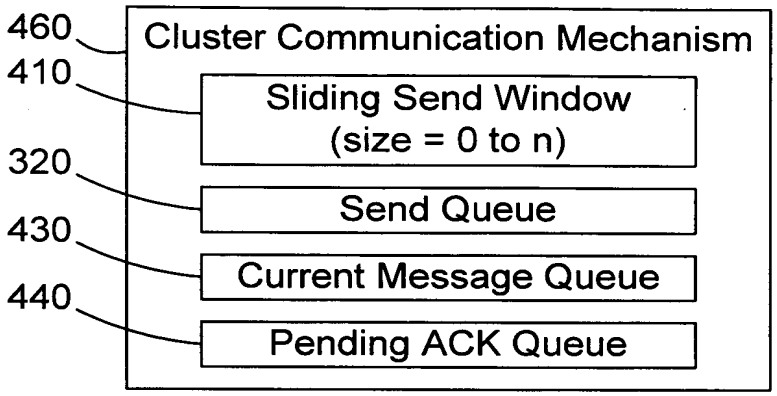


FIG. 4

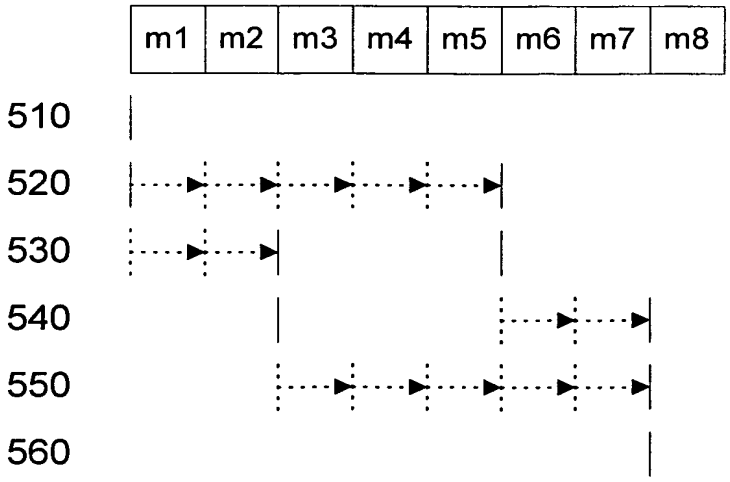


FIG. 5

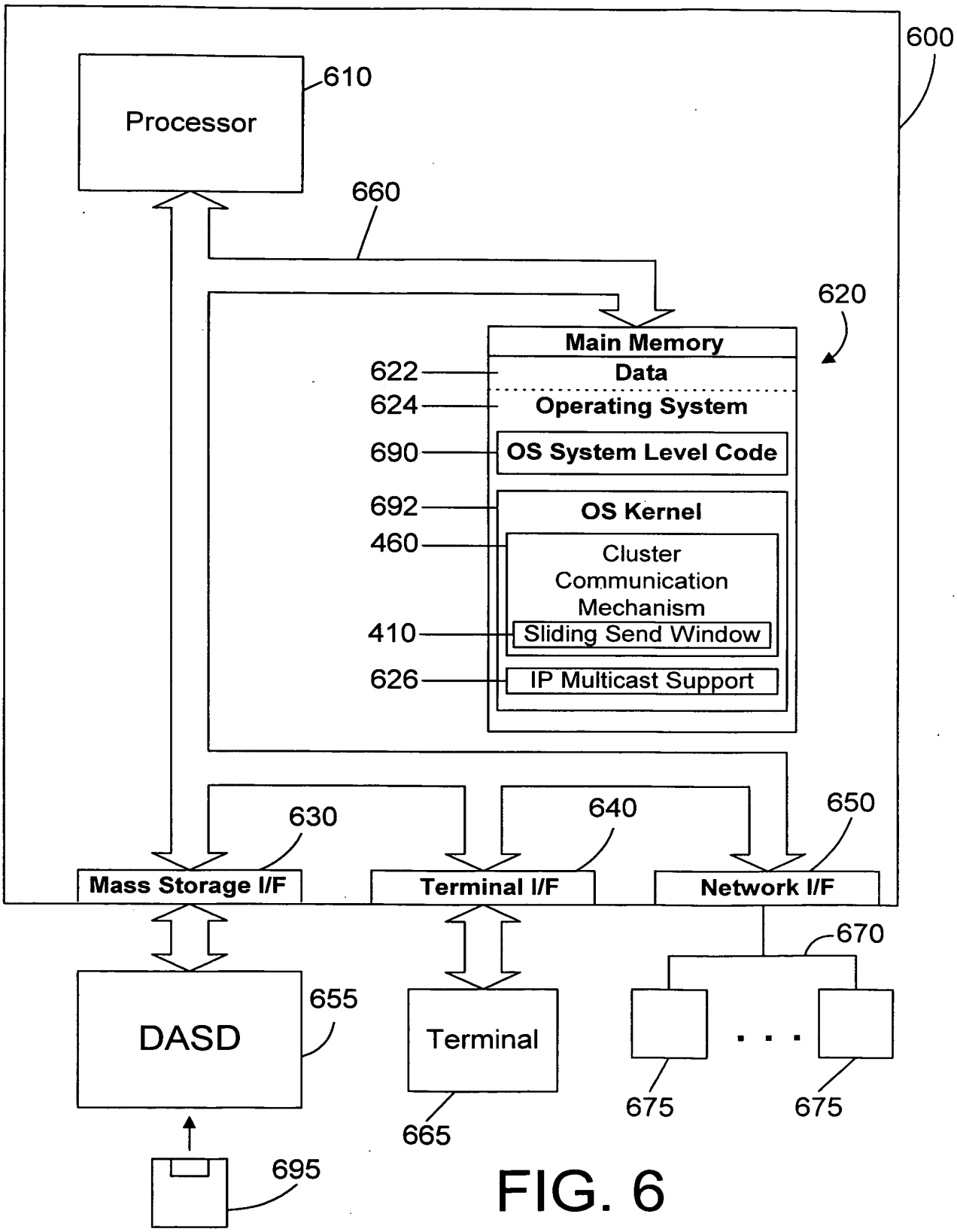

600
Processor
610
660
620
Main Memory
622
Data
624
Operating System
690
OS System Level Code
692
OS Kernel
460
Cluster
Communication
Mechanism
410
Sliding Send Window
626
IP Multicast Support
630
640
650
Mass Storage I/F
Terminal I/F
Network I/F
670
DASD
655
Terminal
665
675
675
695

FIG. 6

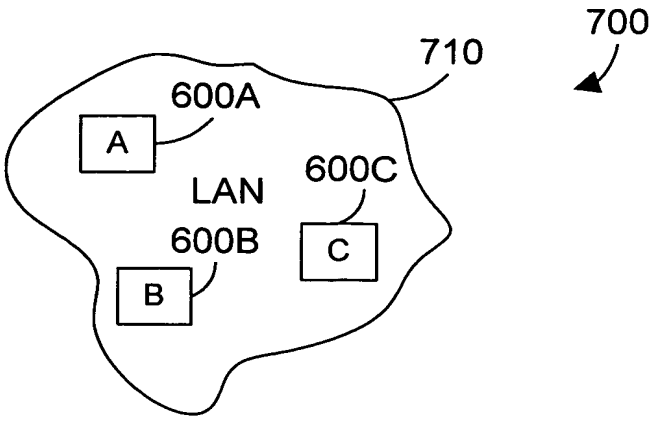
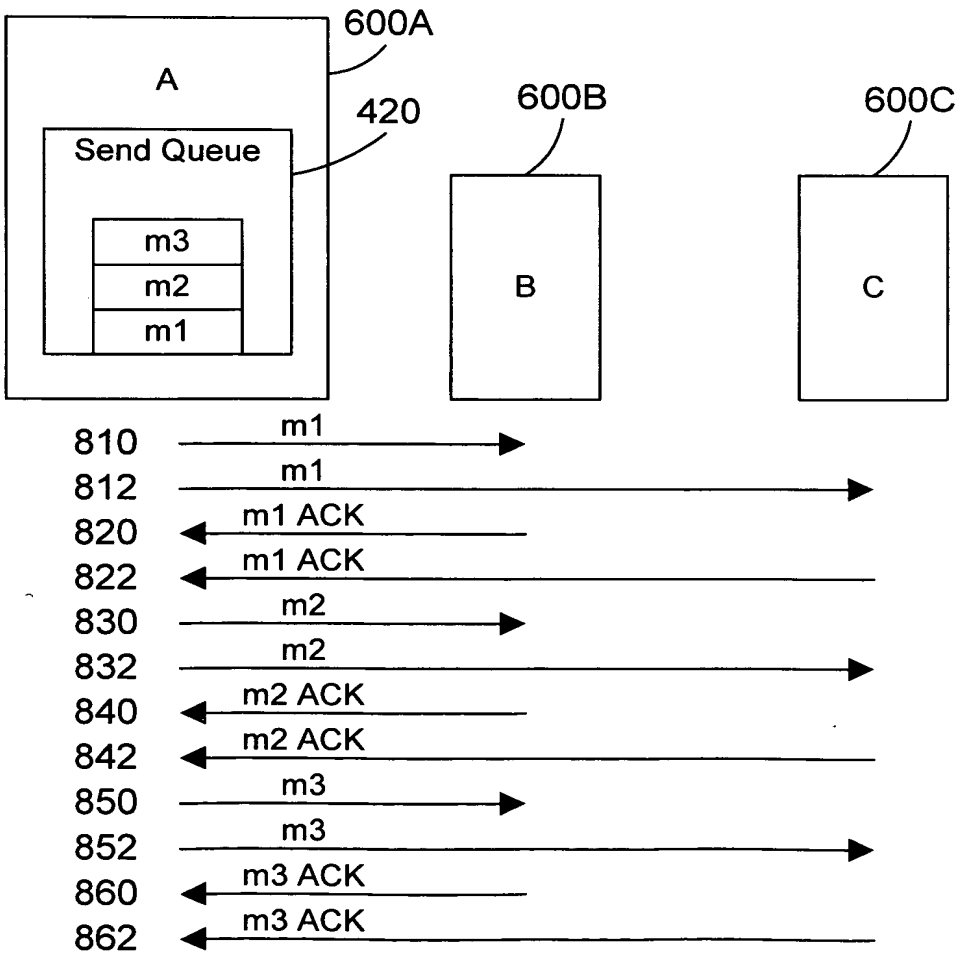


FIG. 7



Prior Art

FIG. 8

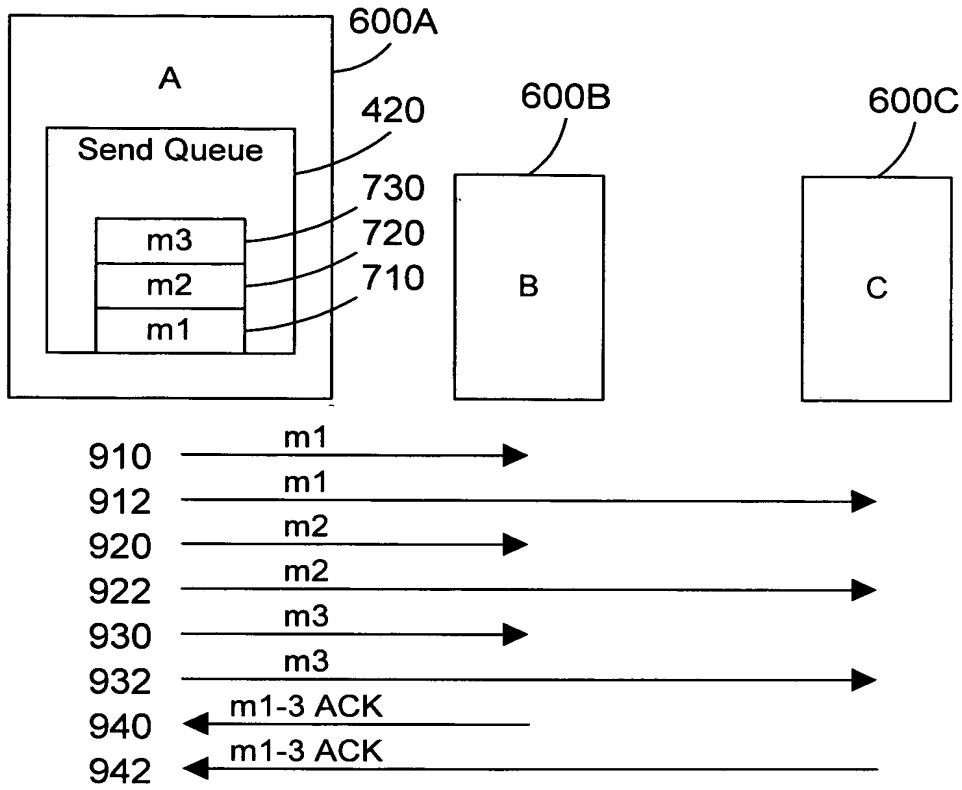

600A
A
420
Send Queue
730
m3
720
m2
710
m1
600B
B
600C
C
910 m1
912 m1
920 m2
922 m2
930 m3
932 m3
940 m1-3 ACK
942 m1-3 ACK

FIG. 9

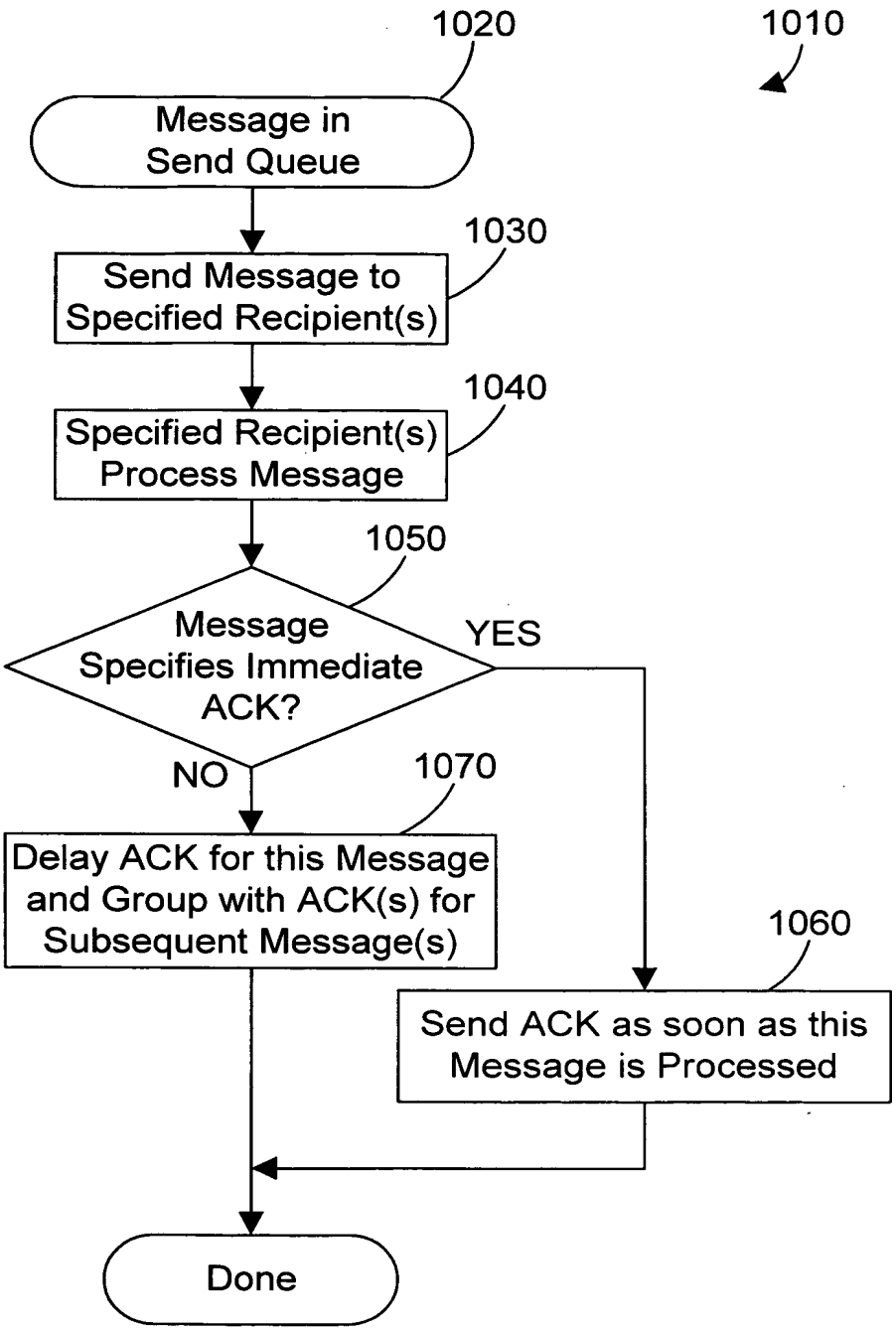

1010
1020
Message in Send Queue
1030
Send Message to Specified Recipient(s)
1040
Specified Recipient(s) Process Message
1050
Message Specifies Immediate ACK?
YES
NO
1070
Delay ACK for this Message and Group with ACK(s) for Subsequent Message(s)
1060
Send ACK as soon as this Message is Processed
Done

FIG. 10

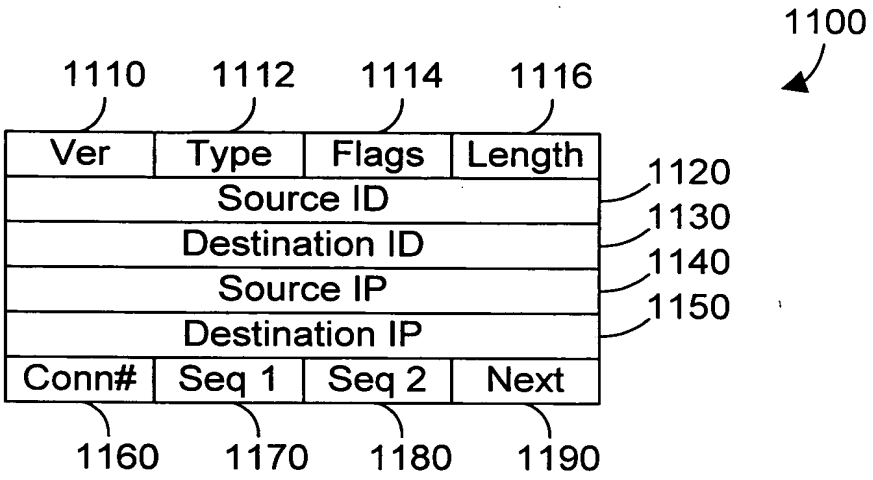


FIG. 11

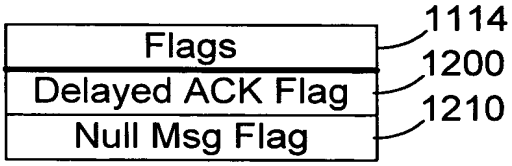


FIG. 12

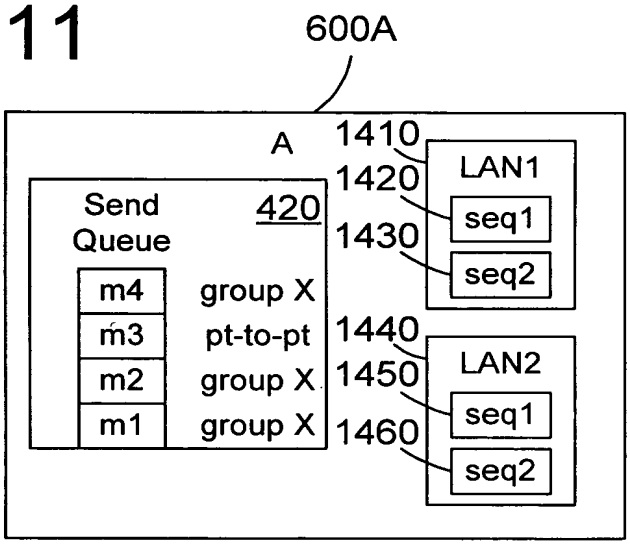


FIG. 14

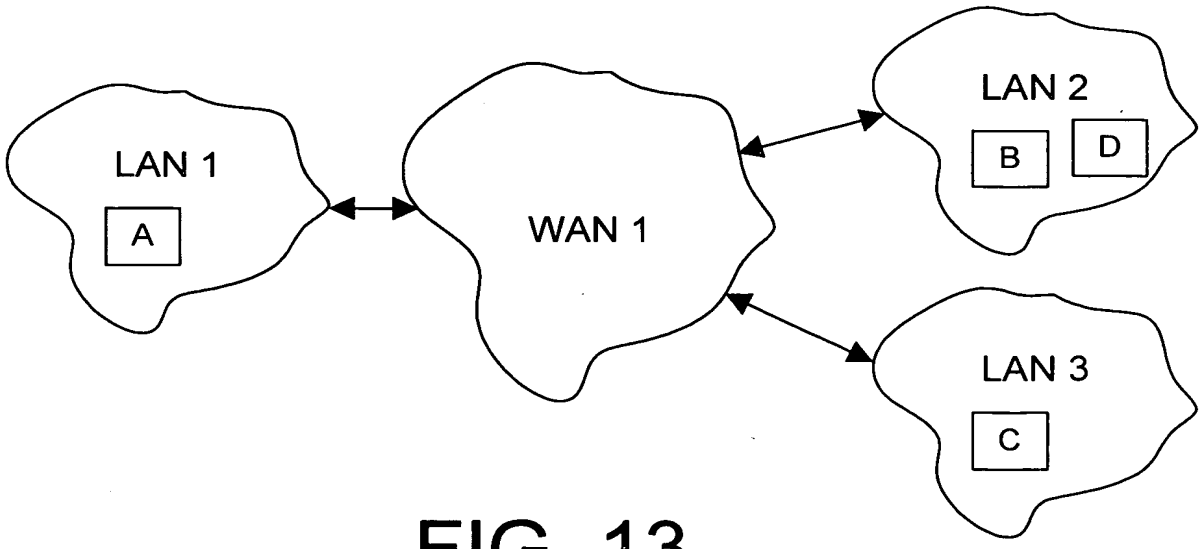
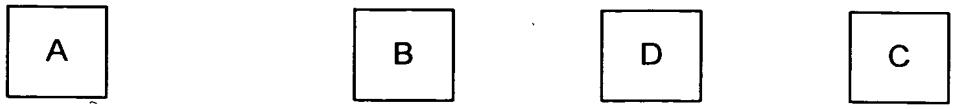


FIG. 13



1: set last msg dest and test dest of next msg for match
if match, set Delayed ACK flag, otherwise clear Delayed ACK flag
2: start msg timer
3: send m1

m1 (seq1=1, seq2=1, Delayed ACK Flag=1)

m1 (seq1=1, seq2=1, Delayed ACK Flag=1)

m1 (seq1=50, seq2=50, Delayed ACK Flag=1)

1': start delayed ACK timer
2': deliver m1 to CLUE

4: test dest of next message (m3) for match with dest of current msg (m2)
if match, set Delayed ACK flag, otherwise clear Delayed ACK flag
5: send m2

m2 (seq1=1, seq2=2, Delayed ACK Flag=0)

m2 (seq1=1, seq2=2, Delayed ACK Flag=0)

m2 (seq1=50, seq2=51, Delayed ACK Flag=0)

3': clear delayed ACK timer
4': deliver m2 to CLUE
5': ACK m1 and m2

seq1=1, seq2=2, ACK

seq1=1, seq2=2, ACK

seq1=50, seq2=51, ACK

FIG. 15

6: test send queue, m3 is last msg in send queue (for the moment)
7: restart msg timer, reset message dest
8: send m3

m3 (seq1=3, seq2=3, Delayed ACK Flag=1)

6': start delayed ACK timer
7': B delivers m1 to its CLUE

9: test latecomer msg m4, dest does not match dest of last msg (m3)
10: send immediate ACK request for m3

seq1=3, seq2=3, Null Msg Flag=1

8': reset delayed ACK timer
9': B delivers requested ACK for m3

seq1=3, seq2=3, ACK

11: restart msg timer, reset message dest
12: send m4

m4 (seq1=4, seq2=4, Delayed ACK Flag=1)

m4 (seq1=4, seq2=4, Delayed ACK Flag=1)

m4 (seq1=52, seq2=52, Delayed ACK Flag=1)

10': B's, D's, and C's delayed ACK timers all fire
11': B, D and C deliver ACK for m4

seq1=4, seq2=4, ACK

seq1=4, seq2=4, ACK

seq1=52, seq2=52, ACK

13: reset msg timer, reset message dest